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Success, attained in a direction in which others have confessedly failed, would indicate some new conditions and qualities; and, confirmatively, it will be found, that in none of the processes quoted as embracing the principles of Sanders's patent, is there a mixture of water-vapor and hydrocarbon, previous to and simultaneous with their decomposition by and in presence of red-hot charcoal.

In the recorded methods of Ibbotson, of the White or Manchester patent, of *Gilbert Sanders*, and of the numerous others who have labored in this department of scientific effort, it will be seen that a mechanical mingling of gases, generated in separate chambers, or at successive stages of the process, is either the avowed object or the actual effect. Such mingling of such gases did not, and necessarily could not, operate efficiently. It could not endure condensation by cold, or time, or the travel through extended mains; and though plentiful and cheap, it could not be depended on for power of illumination or permanence. Water-gas made under Sanders's patent, has been preserved in a gasholder for an entire year, and no diminution of quantity, or deterioration of quality of the gas was sensible.

Upon the famous "Manchester," or "White's Patent Hydro-Carbon" process, described in Clegg's work on Coal Gas, and

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Such is *not* Sanders's process. He insists upon the necessity of the mingling of water vapor and a hydro-carbon, either at the place of vaporization, or in the retort, or on the way thither, *before* (even if but by an inappreciable division of time) the decomposition of either element, in one and the same retort, so that at the instant of generation, under the influence of heat, such new affinities and combinations may be operative as shall produce the gas required.

The very author quoted, (Clegg,) not only states the result of White's Hydro-Carbon Patent as "mechanical," but prefaces his description of the process by remarking that the apparatus is defective, but that "there can be little doubt that ultimately such modifications will be introduced as will render the manufacture as certain as that of ordinary gas-making." These essential modifications, being novel and original conditions, Sanders has accomplished. Within the enclosure of the Market Street Works, at a late date, could be seen the relics of the machinery erected there some years ago, to try the "White" process, and abandoned as a failure. But Sanders's process is a living fact. It is pro-

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SANDERS'S WATER GAS.

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SANDERS'S WATER-GAS.

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SANDERS'S WATER-GAS.

The improvement in the manufacture of illuminating gas, invented and patented by Prof. J. Milton Sanders, and known generally as "Sanders's Water-Gas," consists in the passing of water, in the form of vapor, and any "hydro-carbon," such as rosin, coal oil, &c., into a retort of any form, at a red heat, containing charcoal or other carbonaceous material.

The mixed water-vapor and hydro-carbon are decomposed in association with each other and in the presence of the red hot carbon, and new combinations of a gaseous nature ensue, which are supplied through the usual mains and pipes, and are found, when burned, to possess great luminosity and permanence.

The light derived from gas thus produced, *exceeds in strength*, the light of standard coal-gas. It is of equal or greater *stability*. It is much purer, being free from all sulphurous or nitrous admixture, and emits an odor pleasant,

rather than otherwise. The cost of its manufacture is not more than fifty cents per thousand cubic feet. It can be, has been, and will be, made at a cost still more reduced, according to locality, quantity demanded, and cost of material used.

In addition to its *economy* and *excellence* as an illuminating agent, the *facility* of its manufacture commends it peculiarly to the consideration of all parties interested in gas companies or gas works. To maintain a bench of Water-Gas retorts at a generating heat, for any given time, consumes no more coke or coal, than to maintain at the same heat, a bench of coal-gas retorts for the same period. But the yield per bench of the former will exceed the working ability of the latter, *from three to five hundred per cent.* This remarkable result is a demonstrated fact, involving such a great saving of capital invested in land and machinery, as to be, of itself, worthy of special regard.

For two years past, Prof. Sanders's process has been continuously subjected to a series of experimental and practical tests, and to the adverse criticisms of those engaged in the usual modes of gas making.

About sixteen months ago, by the request of parties resident in the City of Philadelphia, who contemplated the purchase, (since consummated,) of the Patent Right for the State of Pennsylvania, Sanders's process was introduced for purposes of examination at the City Gas Works, Market street, under the superintendence of Prof. J. C. Cresson, Chief Engineer. The report expected from that source, of the

commercial value of Sanders's method, has not yet been communicated to the gentlemen under whose auspices Sanders's Water-Gas was thus brought into public notice. But by the courtesy of Prof. Cresson and his accomplished assistants, very many gentlemen of intelligence, capital, and influential repute in this and neighboring cities, have been permitted to view the practical operation of Sanders's process; the nightly work of the whole establishment being now and having been for several months past carried on by the light of the Water-Gas. Uniform and even enthusiastic testimony to the purity, brilliancy, and economy of Sanders's process, is rendered by all who have thus been favored with the opportunity to inspect its action on a large scale, and is readily accessible by any person interested in the subject. And who has *not* a great interest in the progressive development of such an important accessory of health and civilization?

It has been urged against the claims of this invention, that it is an old and exploded plan; certain unsuccessful attempts in France, Belgium, England, and this country, recorded in text books and scientific journals, by which a mixture of gas produced by the decomposition of water, with other gaseous products, was essayed, being cited against *this* method.

Apart from the *primâ facie* evidence of novelty, implied in the possession of Letters Patent from the United States, (granted after an examination unusually protracted and severe, wherein all these alleged prior discoveries and inventions were closely examined, and not until a successful

practical demonstration had been made at Washington, before a Board of Examiners specially directed by the Commissioner of Patents, to witness the feasibility of the right sought to be protected by patent,) the difference between Sanders's Improvement and precedent failures can be easily shown.

Success, attained in a direction in which others have confessedly failed, would indicate some new conditions and qualities; and, confirmatively, it will be found, that in none of the processes quoted as embracing the principles of Sanders's patent, is there a mixture of water-vapor and hydrocarbon, previous to and simultaneous with their decomposition by and in presence of red-hot charcoal.

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The very author quoted, (Clegg,) not only states the result of White's Hydro-Carbon Patent as "mechanical," but prefaces his description of the process by remarking that the apparatus is defective, but that "there can be little doubt that ultimately such modifications will be introduced as will render the manufacture as certain as that of ordinary gas-making." These essential modifications, being novel and original conditions, Sanders has accomplished. Within the enclosure of the Market Street Works, at a late date, could be seen the relics of the machinery erected there some years ago, to try the "White" process, and abandoned as a failure. But Sanders's process is a living fact. It is pro-

ducing daily its thousands of feet of the best illuminating gas, after a probation of more than a year.

It has also been asserted, in view of the fact that melted *rosin* has been the carbonizing element chiefly used in the experimental trials of this process heretofore, that the increase of the market price of that article, arising from the great demand that would be consequent upon a general adoption of Sanders's invention, would destroy all the contemplated economy of the improvement. To which it may be replied, that Sanders's process is by no means confined to the use of rosin. His patent covers *any* hydro-carbon—a class of substances varied and exhaustless. Already it is ascertained that, by his method, asphaltum from Cuba, of which millions of tons may be delivered here at the present prices of rosin, can be worked to better advantage than rosin, while the advances made in coal oil manufacture, daily cheapening the cost of that valuable adjunct, and the opening of new sources of hydro-carbon in many other quarters forbid any such apprehensions.

It has also been suggested, that the expense of altering existing works would be so great as to hinder a general acceptance of this invention.

Establishments now engaged in the manufacture of coal gas would need no other change, than could be easily and cheaply made whenever the period arrives to renew their present retorts. The term of existence of coal gas retorts is from six to nine months. As the productive capacity of retorts making Water Gas far exceeds that of retorts making

Coal Gas, while the cost of the former is no more than that of the latter, it follows that fewer will be needed to supply the aggregate of present production. Manifestly, therefore, there is an absolute economy of expenditure in the adaptation of the new process.

And, moreover, there cannot be any unusual or costly destruction of apparatus by Sanders's process. A bench of Water Gas retorts may consume more fuel per hour (*not* per thousand feet of gas produced,) than a bench of Coal Gas retorts, but both sorts are exposed to the fire in the same mode of setting, and the degree of heat to be maintained in the manufacture of Water Gas is that which is best adapted to the production of Coal Gas. There is, therefore, no *external* cause of speedy destruction, while within the retort there is no greater pressure, and there are in it fewer gases injurious to iron than in retorts yielding Coal Gas.

The unreasoning and selfish dread of innovation, characterizing all vast vested interests, will naturally seek expression in disparaging statements concerning such a revolutionary invention as Prof. Sanders's process; but believing that Nature will vindicate her own facts and functions, and that the demand of the people for cheaper and better light will be supplied, this explanation of a powerful element in the amelioration of our domestic and social state is respectfully submitted.

Philadelphia, Jan. 13th, 1860.

REPORT
MADE BY
PROFESSOR J. J. MAPES,
TO THE
NEW YORK WATER-GAS COMPANY.

I have visited Philadelphia, and have examined the practical operation of Sanders's method of making Water-Gas, as pursued in a portion of the works of the Philadelphia Gas Company. The engineer, Prof. Cresson, the assistant engineer, Dr. Cresson, and his associate, Mr. Gay, gave me every facility for a thorough and careful examination.

They have been manufacturing gas on this plan for some months, and on my arrival I found one or more of their gas-holders filled with the Water-Gas, and thus had an opportunity of accurately testing its average quality, compared with the average quality of the coal gas manufactured by the company. This was done in my presence by Mr. Gay, and repeated by myself, twice. The instrument used

was the photometer belonging to the company, and which correctly shows the difference in quantity of light produced from a standard candle, consuming one hundred and thirty grains per hour, and the gas to be tested. This proved the Water-Gas to be worth 53, as compared with the company's gas at 47. The minutia of this calculation is with me, and open to inspection.

I spent Monday at the gas house, noticing the manufacture of gas, and rendering myself familiar with the operation, machinery, etc. On Tuesday morning, the 22d inst., the President placed the retort and appurtenances, with the necessary number of hands, at my disposal. The retort was heated red hot, and was charged with 83 lbs. of oak charcoal; the rosin hopper with 60 lbs. of rosin, and the retort was closed at 11 o'clock, the charcoal at that time being under full ignition. The steam was turned on without the rosin, and this furnished gas at the rate of 328 feet per hour, and of a peculiar quality. Its lighting properties were quite low, but the amount of heat evolved from this flame was evidently so much greater than that given off by the burning of the illuminating gas as to render it worthy of special consideration, when its extremely low cost is taken into account. As soon as the rosin became melted, it was suffered to pass slowly into the steam tube, and thus with it to find its way into the retort. The gas immediately assumed a superior degree of brightness, quite exceeding that of a coal gas burner along side, and fully equal in quality, if not superior, to that tested on Monday by the photometer. The steam used was at a

pressure of 25 lbs. to the inch. The fuel used was coke; and the workmen, who are very intelligent and accustomed to running these retorts both with water and coal gas, informed me that the charge then in the retorts would continue to give gas at the same rate, and of the same quality, for 48 hours, at the end of which time half the charcoal would be consumed; that the quantity of coke to run this retort for 48 hours would be from 14 to 16 bushels, and for running the same retort, in the making of coal gas, the quantity required would be 24 to 26 bushels. The information received from these workmen was corroborated the next day by the engineer and Dr. Cresson, as agreeing with their former experiments, except so far as relates to the quantity of coke consumed, which they supposed would be about the same, whether Coal or Water-Gas was made.

The same quantity of coke, however, would run three or more retorts, when properly set in the same bench, instead of one retort, as used in the above experiment. The inventor claims as the rationale for the production of gas, under his plans, that the steam is decomposed by the incandescent carbon, the hydrogen becoming carburetted-hydrogen by combining with portions of the carbon; while the oxygen takes up carbon, becoming carbonic-oxyde.

This is evidently true in degree, as shown in my experiments, with the steam and charcoal alone, before the introduction of the rosin. After the introduction of rosin, its decomposition and combination with the constituents of the steam change the light carburetted hydrogen into heavy or

illuminating carburetted-hydrogen; all of which is a fair hypothesis as to what may go on in the retort. At any rate, whatever may be the modus of the operation or combination within the retort, the practical result is the production of an illuminating gas of a superior quality to that usually made from coal, and at a cost very far below that of coal, oil, or other gas.

On Wednesday, when at the office of the company, the chief and assistant engineers answered the series of questions which I propounded to them. Among the facts arrived at were the following:

Selling price of charcoal at the works, eight cents per bushel.

That two or four retorts might be set in the same bench, and worked by the one fire.

That one man could attend to ten retorts, supplied with two streams of rosin each.

In making of coal gas the quantity of coal used in such a retort as that used by me in making the Water-Gas, would be per day, 2,200 lbs., and in their usual coal gas retorts of double the size, 4,600 lbs.

That in making coal gas, four men would be required per 24 hours to attend nine retorts, worked by three fires.

That the price of coke might be fairly estimated at five cents per bushel.

Prof. Cresson stated that these estimates were entirely dependable, so far as related to Water-Gas, as he had left a fair margin for safety, to prevent an under estimate as to its cost.

Estimate of a bench of Three Retorts for Water-Gas.

249 lbs. of charcoal, 15 bushels, 8 cts.,	-	-	\$1 20
2,350 lbs. of rosin, 50 lbs. per M feet of gas, $\frac{1}{2}$ c.,			11 75
Labor, at the rate of 1 man at \$3, to ten retorts,	-		1 80
Expense of steam,	-	-	50
Cost of purification, not exceeding,	-	-	90
16 bushels of coke, 8 c.,	-	-	1 28
			<hr/>
			\$17 43

As the retort gave 328 feet of gas per hour for 48 hours, the three retorts would give in 48 hours, 47,232 feet, at a cost of \$17 43, or less than 37 cents per M feet, the cost of coal gas made by the company, being \$1 20 per M feet, and the quality as compared with the Water-Gas, only as 47 is to 53.

The retort used for coal gas, I consider quite inappropriate for the making of Water-Gas, notwithstanding the economical results shown above. One of the conditions called for is to pass the steam and the results of the destructive distillation of the rosin through incandescent carbon. This cannot be thoroughly done in a horizontal retort, because the Water-Gas being made partly at the expense of the incandescent carbon, it must leave an upper chamber, through which the steam and the results of rosin may pass above, and not through the incandescent carbon.

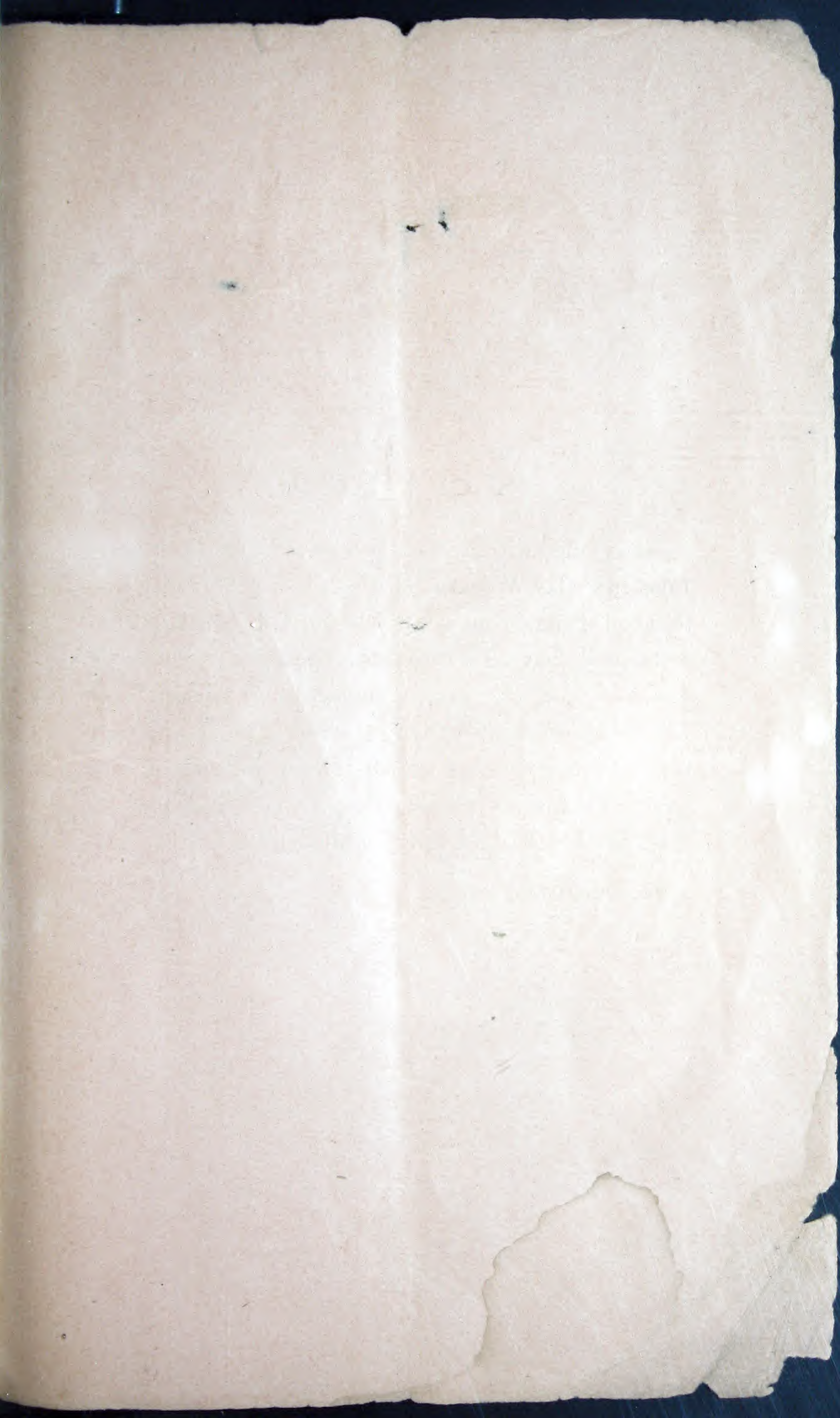
I would recommend a bench of vertical retorts, invented by S. Wetherell, of Bethlehem, Pa., by the use of which every particle of vapor must pass through incandescent coal, even until the last pound in the whole bench of retorts is consumed.

Yours respectfully,

JAS. J. MAPES.

New York, February, 1859.





NOTICE.

Since the within was printed, "THE NORTHERN LIBERTIES GAS WORKS," in the City of Philadelphia, State of Pennsylvania, have erected a Bench of Retorts, and have in successful operation "Sanders's Process," and are now manufacturing thousands of feet, daily, of beautiful Gas, at least equal to any Coal Gas. Parties desirous of judging for themselves, can have opportunities for so doing, by applying to S. M. Day, No. 417 Walnut Street, Philadelphia.

February 16th, 1860.

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